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Overcome Electricity Demands in Smart Cities with Solar Energy

Pooja K[1☼], Monisha M[2]

1. Student, Department of Electronics and Communication, Dhirajlal Gandhi College of Technology, Salem, TamilNadu 636309, India
2. Student, Department of Electronics and Communication, Dhirajlal Gandhi College of Technology, Salem, TamilNadu 636309, India

☼Corresponding Author:
Department of Electronics and Communication, Dhirajlal Gandhi College of Technology, Salem, TamilNadu 636309, India

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ABSTRACT
As the global population continues to grow at a steady pace, more and more people are moving to cities every single day. Experts predict the world's urban population will double by 2050, so Government of India decide to promote smart cities with hifi resources

to bring well infra-structured lifestyle in major preferred cities at pilot bases. In that process, demand of electricity is alarming. The total demand is expected to cross 950,000 MW by 2030, at present India has an installed power generation capacity of 1-4th of expected demand, as well as Transmission and distribution power losses in India reach 33%. We can overcome our future electricity demand by use of solar energy. India has about 300 clear sunny days per year, India has among the highest solar insulations in the world. India receives about 600 TW of solar energy on its land area every year. The daily average solar insulation is 4-7 kWh/sq m, which is far more than current total energy consumption. With such a high solar insulation, even with just 10% conversion efficiency, solar energy will be thousand times greater than electricity demand. To invest of major solar plant cause more financial trouble to government. Instead of fixing major solar plants, to encouraging big household solar plants, compulsion to industries to generate power from solar energy and encourage innovative ideas to create low cost solar panels and use of DTH dishes to observe and generate energy will reduce government burden and sacrifices a demand of smart cities power demand. This paper elucidates about Different Energy sources, why we are going for non-conventional energy sources, Different non-conventional energy sources & comparison between them, about solar cells and their applications.

Keywords: Smart city, Hifi, MW megawatt, KW kilowatt, TW ton watt, (T&D) Transmission and distribution, solar panels, DTH direct to home.

1. INTRODUCTION

The terminology smart city is discussing and spread different thoughts to all over India. But main goal of that scheme is connect over city in technology. As the global population continues to grow at a steady pace, more and more people are moving to cities every single day. Experts predict the world's urban population will double by 2050, so Government of India decide to promote smart cities with hifi resources to bring well infra- structured lifestyle in major preferred cities at pilot bases. Urbanization brings several problems like housing, sanitation, transport, water, electricity, health, education and so on. But development process in smart cities electricity plays a major role. So in this paper we discuss about how to overcome electricity necessity.

2. ELECTRICITY/POWER IN INDIA

- India has an installed power generation capacity of more or less 200,000 MW
- The total demand for power is expected to cross 950,000 MW by 2030
- Main sources of power in India include thermal power, hydro power and nuclear power
- Private sector contributes around 13.5% to total power generation
- The per capita power consumption in India is 612 kWh

3. SOLAR POWERS IN INDIA

- **India (along with USA) ranks number one in solar power generation in world**. However, it still only contributes about 0.4% of total electricity generation in the country. India's high population density and high solar insolation provide an ideal combination for solar power India.
- **Solar insulation is a measure of the solar energy received on a given surface area in a given time.** It is usually expressed in W/Sq. m.
- **In 2009, the Government unveiled a plan to generated 20,000 MW of solar power by 2020.** Under the plan solar powered equipment and applications would be mandatory in all government buildings presently solar power is primarily advocated in villages for water pumps, replacing the millions of diesel powered water pumps. Since the villages are not integrated into the power grids, stand-along solar units are especially helpful

3.1. Solar plants

Solar power is the conversion of sunlight into electricity, either directly using photovoltaic (PV), or indirectly using concentrated solar power (CSP).CSP systems use lenses or mirrors and tracking systems to focus a large area of sunlight into a small beam. PV converts light into electric current using the photoelectric effect.

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Commercial CSP plants were first developed in the 1980s. Since 1985 the eventually 354 MW SEGS CSP installations, in the Mojave Desert of California, is the largest solar power plant in the world. Other large CSP plants include the 150 MW Solnova Solar Power Station and the 100 MW Andasol solar power station, both in Spain. The 250 MW Agua Caliente Solar Project, in the United States, and the 221 MW Charanka Solar Park in India, are the world's largest photovoltaic plants. Solar projects exceeding 1 GW are being developed, but most of the deployed photovoltaic are in small rooftop arrays of less than 5 kW, which are grid connected using net metering and/or a feed-in tariff.

3.2. Disadvantages in existing solar power generation

Among the renewable resources, photovoltaic panels and wind-generators are primary contenders. They have the advantage of being maintenance and pollution-free, but their installation cost is high and, in most applications, they require a power conditioner (dc/dc or dc/ac converter) for load interface. Photo Voltaic modules (PV Modules) also have relatively low conversion efficiency. Overall system cost can be reduced using high efficiency power conditioners which are designed to extract the maximum possible power from the PV module using maximum power point tracking (MPPT) techniques. Existing panel systems also have the disadvantage of being oriented in one single direction throughout the day resulting in less direct exposure to actual sunlight.

4. PROPOSED PLANS

4.1. Proposed plan 1

The main component of the system is a microcontroller or a Soc. The complete intelligence of the system lies in this single chip and it is reconfigurable and upgradable. On the solar panel, two photodiodes are kept perpendicular to the plane of the panel and the photodiode output is fed to the microcontroller (MCU). These diodes and a DC motor determine the orientation of the panel. Based on the photodiode inputs, the MCU controls the DC motor and orients the solar panel to receive maximum illumination. The two photo-diodes used for sun tracking are reverse-biased, meaning the reverse current through these diodes varies with the light incident on them. Under nominal daylight, the reverse current varies between 10uA and 75uA. The Reverse Dark Current (when no light is incident on the photodiodes) is only a few NA.

A Trans-Impedance Amplifier (TIA) is used to convert the reverse current to an equivalent voltage. The gain of the amplifier is set using a feedback resistor.

Photodiodes often have substantial output capacitance. This requires shunt feedback capacitance in the TIA in order to guarantee stability and to provide bandwidth limiting to reduce broadband noise. The output voltage of TIA, Vout, is determined by the following equation:

$$Vout = Vref - Iin * Rfb$$

Where Rfb is resistive feedback, Iin is the current from the photodiode and Vref is the reference voltage connected to the positive terminal of the op-amp.

The output voltages are digitized using an on-chip ADC. Since the reverse current is very small (few tens of UA), the ADC must be able to resolve smaller voltages which requires a precision reference voltage. The output of each sensor is filtered using an IIR filter equation implemented in firmware which removes any abrupt jump in the light intensity variation. There is more than one voltage being measured using a single ADC in this system. The digitized values corresponding to the two diodes are compared continuously. If the difference between the two values is within a predetermined threshold band, the panel position is held stationary. If the difference exceeds the threshold, the panel is tilted in the direction of higher intensity until the difference comes into the threshold band. In this way we can orient the panel in the direction of maximum light intensity.

The DC motors are driven by a PWM signal generated by the MCU. The PWM duty-cycle determines the speed at which the motors rotate. The duty-cycle is kept small in order to have slow and precise movement. As the panel orients itself in the direction of maximum light, the PWM duty-cycle is gradually reduced.

A possible use case could be a 16-bit PWM with 65535 steps. With such small steps, it is possible to track the sun precisely from dawn to dusk.

The motor current is on the order of tens of mA for movement. The GPIOs of the MCU can't source sufficient current to drive the motors. This is augmented by having a motor driver chip. The driver has an H-Bridge structure which allows for digital control of the

direction of motor current and hence the direction of the motor. The driver is capable of sourcing a current of 1A. Also note that the tracking mechanism is such that the motor is being pulsed intermittently and at regular intervals (once every few minutes). Hence, the average current spent driving the motor is significantly small.

There are two switches connected to the MCU. These switches are triggered by the panel rotation when the panel reaches extreme positions (East and West) and they determine the maximum possible rotation. There is a supplementary real time clock running on the MCU which keeps track of the timing so that, once the sun sets and light intensity has died down significantly, the panel is brought back to the initial position that makes the panel face East. The panel tracks the sun the next day and continues process.

4.2. Proposed plan 2

In every households having DTH dishes. These dishes are used to absorb radio waves and convert into TV broadcasts. If we include PVs and small transformers as well as micro-electric chips which are using in laptops in that dishes we can reduce cost and space problems. Increasing productivity as well as minor productivity necessity cost will cheaper.

5. ADVANTAGES OF USING SOLAR POWER

The most important advantage is neither pollution nor wiring costing. In Transmission and distribution (T&D) losses in India reach 33% Losses include technical losses such as unplanned lines, overloading, and commercial losses such as theft, pilferage etc. we can eliminate this also.

6. CONCLUSION

Sun is the major resource for the world. In future solar energy is major resources for development of human.

REFERENCES

1. www.iasexamportal/priliminary,india geography study material.
2. Simple techniques to improve solar panel efficiency using a microcontroller or soc By Udayan Umapathi,
3. Applications Engineer at Cypress Semiconductor and Gautam Das G, Applications Engineer at Cypress
4. Science daily e-magazine date: January 23, 2015
5. http://www.alternative-energy-news.info/favicon.ico?v=3D1.1"><LIN=